Chemistry 341
Problem Set 5
10/8/01

Print Name

Circle your TA's name

Nate Bowling  
Wendy deProphetis  
Gina Gencarelli

Brian Lucas
Neil Stroitman

Mon 3:30 pm  
Tues 3:30 pm

4:35 pm  
4:35 pm

Circle the day and time of your Discussion Session

This assignment is due on Friday, October 12th at 11:00 am.
Each question is worth 10 points.

1. Indicate the stereogenic centers in the following molecules with an asterisk (*), and assign the absolute stereochemical configuration (R or S).

Carvone (spearmint oil)

Nootkatone (grapefruit oil)

+2 pts indicating stereogenic center
+2 pts R or S
+1 pt each stereogenic center
+1 pt each R or S

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2. Eight isomeric alcohols have the formula C₅H₁₂O. Draw them. Indicate which of the isomers are chiral. (Try to approach this question in a systematic way. That will help you identify all eight possible isomers.)

\[ \text{unsaturation} = \text{# Carbon} - \frac{1}{2}(\text{# H}) + \frac{1}{2}(\text{# N}) + 1 \]

\[ = 5 - \frac{1}{2}(12) + 0 + 1 \]

\[ = 0 \]

⇒ completely saturated
   no rings or multiple bonds

\[ \text{HO-CH₂} - \text{CH₂-CH₂-CH₂-CH₂-CH₂-OH} \]

\[ \text{HO-CH₂-CH₂-CH₂-CH₂-OH} \]

\[ \text{HO-CH₂-CH₂-CH₂-OH} \]

\[ \text{HO-CH₂-CH₂-OH} \]

\[ \text{HO-CH₂-OH} \]

\[ \text{HO-CH₂} \]

+ 1pt for each correct structure

+ 1pt for each chiral compound

\[ \frac{11 \text{ pts} \ - \ \text{total}}{} \]

alcohols derived from 5-C chain

alcohols derived from 4-C chain

alcohols derived from 3-C chain

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3. Specify the stereochemical relationship between each pair of structures given below.

A and B  \[\text{enantiomers}\]

A and C  \[\text{diastereomers}\]

A and D  \[\text{identical}\]

A and E  \[\text{diastereomers}\]

B and C  \[\text{diastereomers}\]

B and D  \[\text{enantiomers}\]

B and E  \[\text{diastereomers}\]

C and D  \[\text{diastereomers}\]

C and E  \[\text{enantiomers}\]

D and E  \[\text{diastereomers}\]
4. Compound A, C₇H₁₄, is optically active. On catalytic reduction over a palladium catalyst, 1 equiv. of H₂ is absorbed, yielding compound B, C₇H₁₆. Ozonolysis of A affords two fragments. One fragment is identified as acetaldehyde, CH₃CHO, and the other fragment, compound C, is an optically active aldehyde. Formulate the reactions, and propose structures for compounds A, B, and C.

\[ \text{unsaturation number} = \frac{\# C}{2} \left( \# H \right) + 1 \]
\[ = 7 - \frac{1}{2} \times (4) + 1 \]
\[ = 1 \]
\[ \Rightarrow \text{one ring or double bond} \]

\[ \text{A} \quad \text{C₇H₁₄} \quad \xrightarrow{\text{H₂}} \quad \text{B} \quad \text{C₇H₁₆} \]

\[ \text{CH₃} \quad \text{C=O} \] + \[ \text{CH₃} \quad \text{C} \]
\[ \text{H} \] \text{chiral} \text{aldehyde}

\[ \text{H} \quad \text{C} = \text{C} \quad \text{CH₂CH₂CH₂CH₃} \]

\[ \text{CH₃} \quad \text{C=H} \]

\[ \text{H} \quad \text{C} = \text{C} \quad \text{CH₂CH₃} \]

\[ \text{CH₃} \quad \text{C=H} \quad \text{CH₃} \]

\[ \text{H} \quad \text{C} = \text{C} \quad \text{CH₂CH₃} \]

\[ \text{CH₃} \quad \text{C=H} \quad \text{CH₃} \]

Logical Deductions
1. Since A reacts with H₂ and O₃, the type of unsaturation must be double bond.
2. The aldehyde carbon in C must have been the site of the alkene cannot be correct because molecules are chiral.

(continued, next page)
A could be either cis or trans (cannot distinguish from the information given)

1) D_3
2) Zn/H_2O^+

B 3-methyl hexane

C